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uatic Vascular Plants of New England: Part 5. Araceae, Lemnaceae, Xyridaceae, Eriocaulaceae, and Pontederiaceae

by

C. B. Hellquist and G. E. Crow

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AGRICULTURAL EXPERIMENT STATION
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ABSTRACT

This paper is the fifth in a series of reports on the aquatic and wetland flora of New England. It treats all species of the Araceae, Lemnaceae, Xyridaceae, Eriocaulaceae, and Pontederiaceae occurring in New England and includes keys, comments on taxonomy and nomenclature, habitat and distributional information, water chemistry data, illustrations, and dot maps. Those species regarded as rare and endangered in the New England Region or in one or more of the six New England states are also noted.

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KEY WORDS: Aquatic plants, New England Flora, Taxonomy, Araceae, Lemnaceae, Xyridaceae, Eriocaulaceae, Pontederiaceae, *Acorus*, *Orontium*, *Peltandra*, *Calla*, *Symplocarpus*, *Wolffia*, *Wolffiella*, *Spirodela*, *Lemna*, *Xyris*, *Eriocaulon*, *Pontederia*, *Heteranthera*, Sweet-flag, Calamus, Golden-club, Arrow-arum, Water-arum, Wild Calla, Skunk-cabbage, Water-meal, Mud-midget, Duckweed, Yellow-eyed Grass, Pipewort, Pickerel-weed.

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Aquatic Vascular Plants of New England: Part 5. Araceae, Lemnaceae, Xyridaceae, Eriocaulaceae, and Pontederiaceae

by

C. B. Hellquist and G. E. Crow

INTRODUCTION

This is the fifth in a series of reports on the aquatic and wetland flora of New England. This long needed treatment has been prepared to aid conservationists, fish and game personnel, consultants, botanists, and students in the identification of aquatic plants. The coverage is strictly New England but is of value throughout the northeast. Data have been gathered from herbaria in New England and from personal field work.

Chemical data presented represent samples from many waters throughout New England. The alkalinity readings are total alkalinity, expressed as milligrams per liter (mg/l) $CaCO^3$. The number of observations are included in parentheses following alkalinity and pH values. Since pH and alkalinity vary greatly during the day, the values are only indicative of the water quality. Chloride values are given where data are available and of value.

The rare and endangered plant lists referred to are those prepared for each of the six New England states by the New England Botanical Club in cooperation with the United States Fish and Wildlife Service, Office of Endangered Species, Newton Corner, MA (RI — Church and Champlin, 1978; MA — Coddington and Field, 1978; VT — Countryman, 1978; ME — Eastman, 1978; CT — Mehrhoff, 1978; NH — Storks and Crow, 1978). Taxa indicated as rare, threatened, or endangered for the entire New England Region are also noted (Crow *et al.*, 1981, Rhodora 82: 259-299).

We invite comments and/or criticisms on this treatment. Information on any species omitted or any known localities not documented by us will be welcomed. If anyone is interested in specific localities of any of the species indicated on the dot maps, please contact us.

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Dr. G. E. Crow, Department of Botany and Plant Pathology, Nesmith Hall, University of New Hampshire, Durham, NH 03824.

ARACEAE

1. Leaves narrow, long-linear, iris-like (fig. 1A); spadix appearing lateral on leaf-like axis, with spathe resembling a leaf (fig. 1A); rhizomes producing a sweet odor.
   ..... 1. *Acorus*
1. Leaves broadened (figs. 1C, 2B, 3A, 4B); spadix terminal; spathe enveloping the spadix (figs. 2C, 3B, 4A,C) or reduced to a basal sheath (fig. 1D), not leaf-like; rhizomes not producing a sweet odor.
   2. Spadix golden-yellow; spathe obscure, forming a sheath at the base of the long scape (fig. 1D); leaves broadly oblong-elliptic.
      ..... 2. *Orontium*
   2. Spadix green or brown; spathe broad, conspicuous; leaves ovate, cordate, hastate, or sagittate.
      3. Leaf blades hastate or sagittate (juvenile unlobed), with a prominent vein extending into each basal lobe (fig. 2B).
         ..... 3. *Peltandra*
      3. Leaf blades broadly rounded to cordate (fig. 3A, 4B), lacking a prominent vein extending into the basal lobes (if present).
         4. Spathe white; spadix on a long peduncle (fig. 3A,B), emerging after leaves; plant lacking a strong odor.
            ..... 4. *Calla*
         4. Spathe mottled, purplish-green and/or reddish-brown; spadix appearing sessile (fig. 4A), emerging very early, before leaves; plant with a strong skunk-like odor when bruised.
            ..... 5. *Symplocarpus*

Acorus (Sweet-flag, Calamus)

Emersed perennial of wet meadows, marshes, and shores; growing from a thick, creeping, aromatic rhizome; leaves long-linear; flowers perfect, borne on a spadix, 3-merous, greenish; fruit a gelatinous, few-seeded berry.

1. *Acorus calamus* L. Fig. 1, Map 1

Common in wet meadows, marshes, ponds, and stream banks throughout New England. This species is often confused in the sterile state with *Iris*, but is easily identified by the sweet odor of the lower portion of the leaves and rhizomes. Range extends from Nova Scotia, Prince Edward Island, and Quebec west to Minnesota, Montana, Idaho, and Oregon, south to Florida and Texas.

Orontium (Golden-club)

Emersed or submersed plants of shallow waters, and sandy, muddy, and peaty shores. Perennial, growing from a deep rhizome; leaves basal, long-petioled, entire; flowers perfect, borne on a spadix, spathe reduced, obscure at base of scape; fruit a blue-green or brownish utricle.

1. *Orontium aquaticum* L. Fig. 1, Map 2

Rare, in shallow water and along shores of rivers and ponds in New England. This species is presently known from less than 20 sites throughout southern New England. Range extends from Massachusetts and central New York, Pennsylvania, West Virginia, and Kentucky, south to Florida and Louisiana.

Rare and endangered plant lists: New England, Massachusetts, Rhode Island, Connecticut

Peltandra (Arrow-arum)

Emergent perennial, growing from thick fibrous or subtuberous roots; leaves basal, long-petioled, blades hastate or sagittate; upper flowers of the spadix staminate, lower ones pistillate; fruit an amber or green berry.

1. *Peltandra virginica* (L.) Schott and Endl. Fig. 2, Map 3

Common in damp meadows, bogs, and swamps and along shores of rivers, ponds, and streams from central New England south. Sterile plants are often confused with several species of *Sagittaria* or *Pontederia cordata* L., but can be easily differentiated by the two veins paralleling the leaf margins and by a single prominent midvein and a prominent vein extending into each basal lobe. This is a highly variable species that has had many dubious forms based solely on leaf shapes. Range extends from central Maine and southern Quebec west to Michigan, Ontario, and Wisconsin, south to Florida, southeastern Oklahoma, and Texas.

alkalinity: mean 15.8 mg/l; range 1.0-89.0 mg/l; (18)
pH: mean 7.0; range 5.6-9.5; (15)

Calla (Water-arum, Wild Calla)

Emersed perennial, growing from a long creeping rhizome; leaves cordate, long-petioled; flowers perfect, borne on a spadix; spathe ovate,

Figure 1.
Acorus calamus: **A. habit × ⅛. B. spadix × ½.**
Orontium aquaticum: **C. habit of terrestrial plant × ⅛. D. spadix with reduced spathe × ½. E. habit of submersed plant × ⅛. F. submerged juvenile stage × ⅛.**

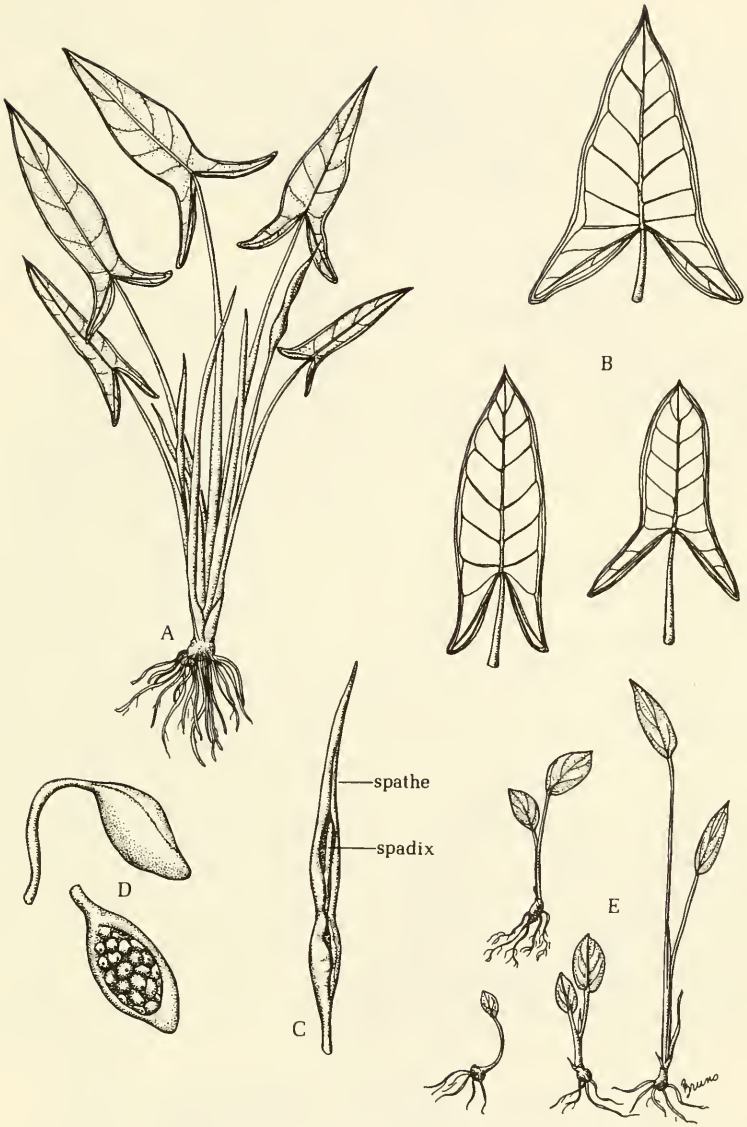
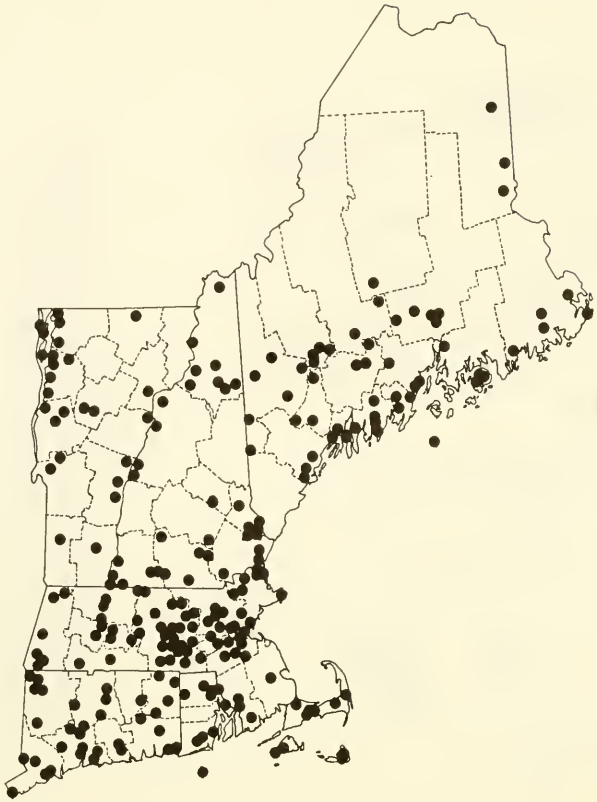
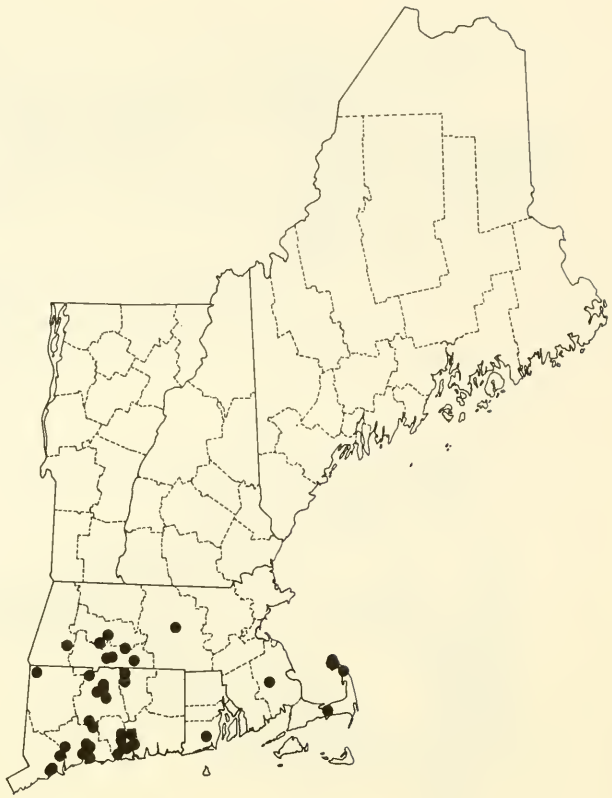


Figure 2.
Peltandra virginica: **A. habit × 1/6. B. variations in leaf shape × 1/8. C. spathe and spadix × 1/4. D. spadix at fruiting stage (spathe cut away below) × 1/4. E. seedlings to juvenile stages × 1/8.**



Map 1.
Acorus calamus



Map 2.
Orontium aquaticum

pointed, upper surface white; fruit a red berry.

1. *Calla palustris* L. Fig. 3, Map 4

Common throughout New England in wooded swamps, marshes, and bogs and along marshy shores of rivers, ponds, and lakes. Range extends from Newfoundland and Labrador to Alaska, south to northern New Jersey, Pennsylvania, northern Indiana, Wisconsin, and Minnesota.

Symplocarpus (Skunk-cabbage)

Emersed perennial, growing from a stout erect rhizome; leaves ovate to cordate, short-petioled; flowers perfect, borne on a spadix, subtended by a mottled purplish-green and/or reddish-brown spathe; ovaries imbedded in spadix; fruit a globular or ovoid mass; entire plant producing a foul skunk-like odor.

1. *Symplocarpus foetidus* (L.) Nutt. Fig. 4, Map 5

Widely scattered in northern New England, common in southern New England in wet woods, meadows, swamps, bogs, and along stream borders. This is one of the earliest plants to flower in New England, with the flowers emerging in March, followed by leaf emergence in April. Range extends from Nova Scotia and Quebec west to southeastern Manitoba, south to Georgia, Tennessee, Ohio, Indiana, central Illinois, and Iowa.

The Araceae also include *Arisaema triphyllum* (L.) Schott (Jack-in-the-pulpit) and *Arisaema dracontium* (L.) Schott (Green Dragon), which are occasionally found in wet woods or on alluvial plains. These are not included in the treatment since we do not consider them to be truly wetland species. There is a record of *Pistia stratiotes* L. collected from the Concord River, Massachusetts. This species is not winter hardy and surely was introduced into the river the summer it was collected.

Selected References

Blake, S. F. 1912. The forms of *Peltandra virginica*. Rhodora 14: 102-106.

Buell, M. F. 1935. *Acorus calamus* in America. Rhodora 37: 367-369.

Grear, J. W., Jr. 1966. Cytogeography of *Orontium aquaticum*. Rhodora 68: 25-34.

Löve, A. and D. Löve. 1957. Drug content and polyploidy in *Acorus*. Proc. Genet. Soc. Canada 2: 14-17.

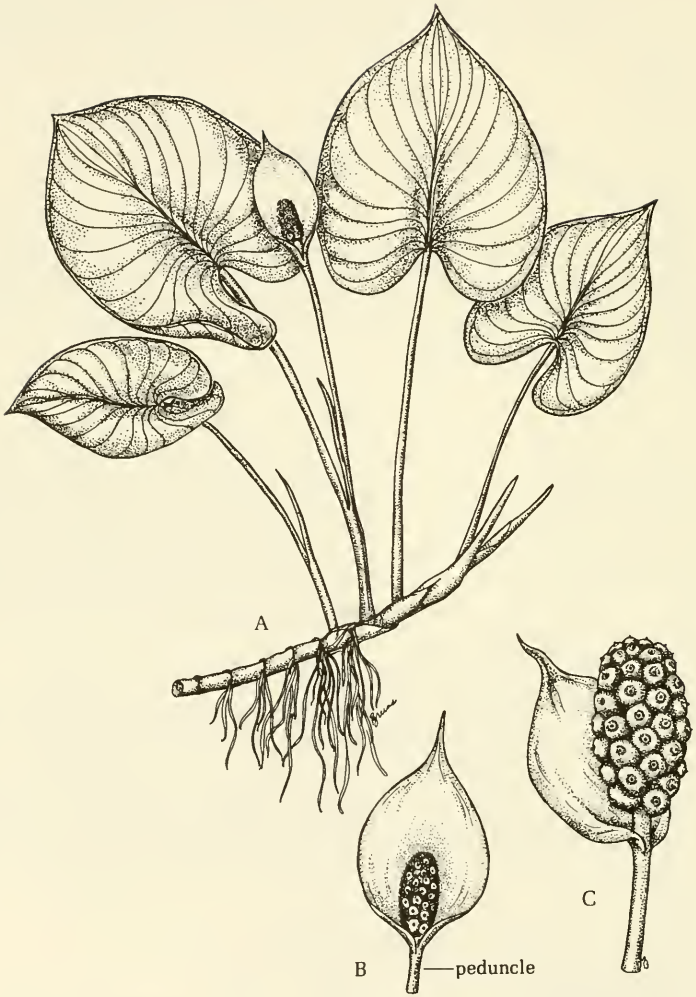


Figure 3.
Calla palustris: **A. habit × ¼. B. spathe and spadix × ½. C. spadix at fruiting stage × ½.**

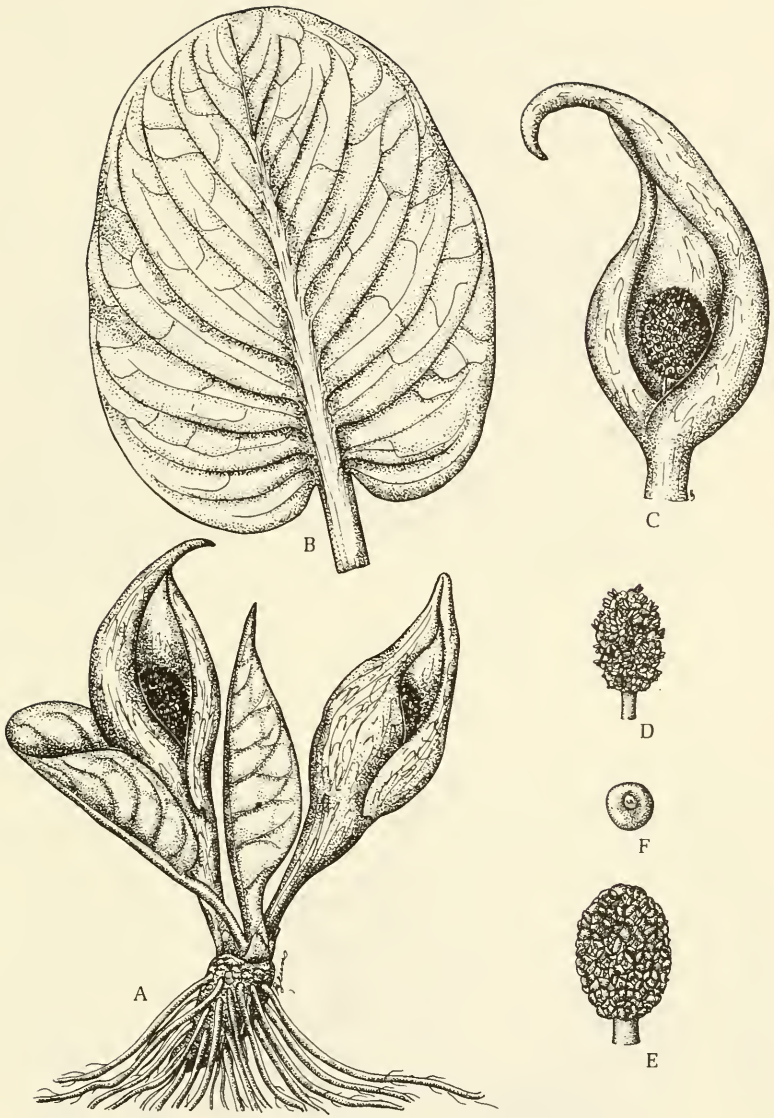
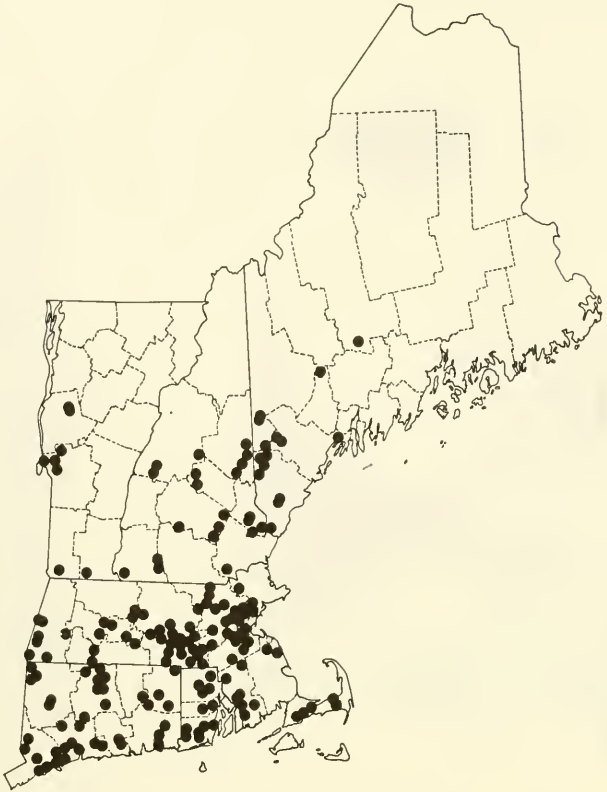
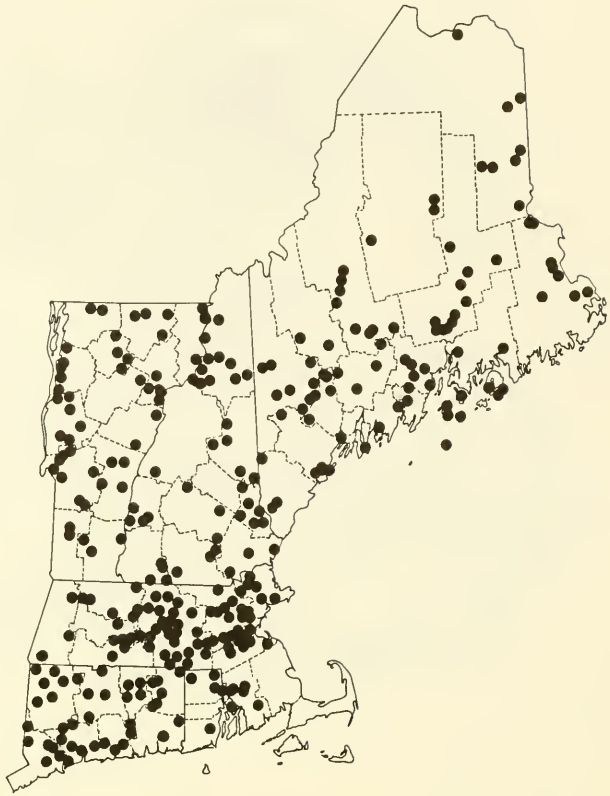


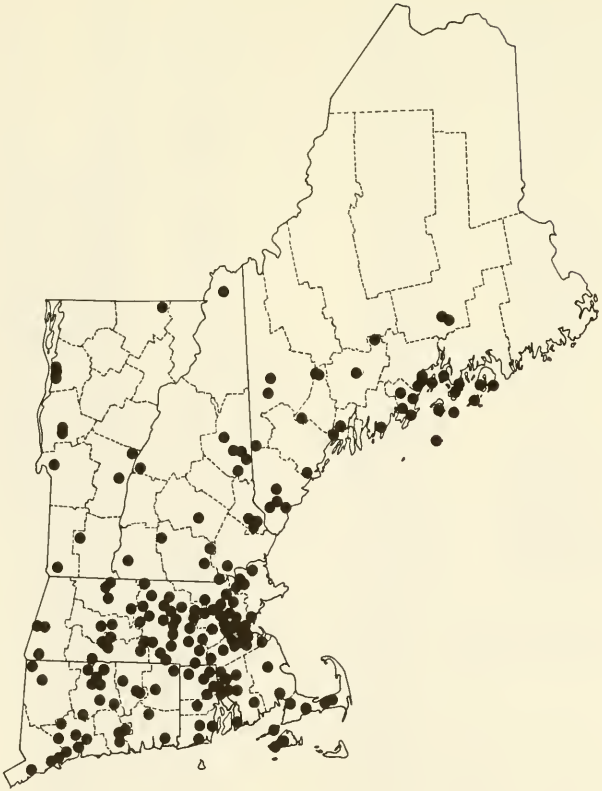
Figure 4.
Symplocarpus foetidus: **A. habit × ¼. B. leaf × ¼. C. spathe and spadix × ¼. D. spadix of male flowers × ½. E. spadix of female flowers × ½. F. fruit × ½.**



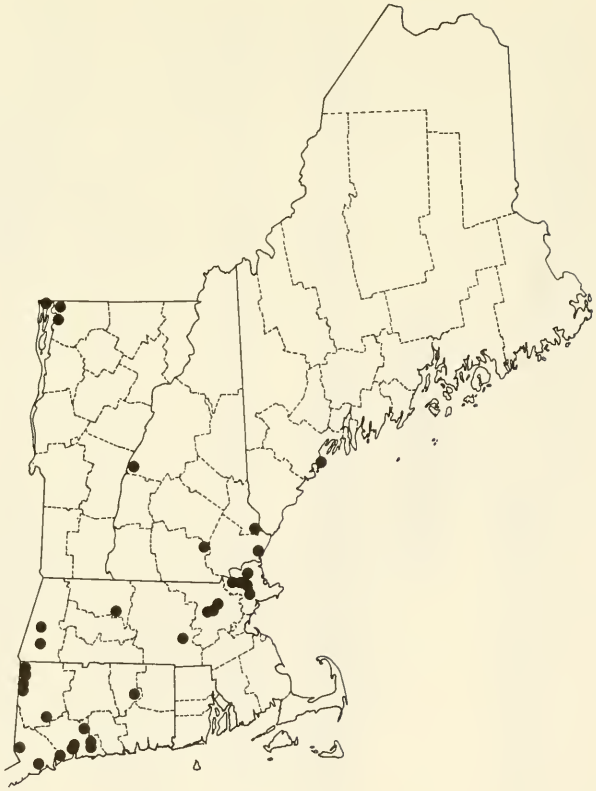
Map 3.
Peltandra virginica



Map 4.
Calla palustris



Map 5.
Symplocarpus foetidus



Map 6.
Wolffia columbiana

Tidestrom, I. 1910. Notes on *Peltandra,* Rafinesque. Rhodora 12: 47-50.

Wilson, K. A. 1960. Genera of Arales in the southeast United States. J. Arnold Arbor. 41: 47-72.

LEMNACEAE

1. Plants lacking roots (fig. 5A,B,C,D).
   2. Fronds 1.5 mm or less long, thick, globular or ellipsoidal (fig. 5A,B,C).
      ..... *Wolffia*
   2. Fronds 6-8 mm long, thin, slender, elongate, sickle-shaped (fig. 5D).
      ..... *Wolffiella*
1. Plants with roots (fig. 5E, 6).
   3. Frond with two or more roots, solid reddish-purple on the underside, upper surface with 3-11 nerves (fig. 5E).
      ..... *Spirodela*
   3. Frond with a single root, green or slightly purple on the underside, upper surface with 1-3 nerves (fig. 6).
      ..... *Lemna*

Wolffia (Water-meal)

Minute floating plants of quiet waters, usually in small ponds, river backwaters, and ditches; rootless; fronds greatly reduced; flowers rare, consisting of one pistillate and one staminate (with a single stamen) flower enclosed in a sac-like spathe; fruit a utricle; vegetative reproduction extensive.

This genus contains the smallest known flowering plants. The species are extremely difficult to identify, especially if allowed to dry. Every effort should be made to identify *Wolffia* while material is fresh or is preserved in liquid, not dried.

Key to Species

1. Frond globular (fig. 5A), not dotted, some plants below surface under crowded conditions.
   ..... 1. *W. columbiana*
1. Frond ellipsoidal (fig. 5B,C), dotted, floating on surface when crowded.
   2. Upper suface flattened (fig. 5B).
      ..... 2. *W. borealis*

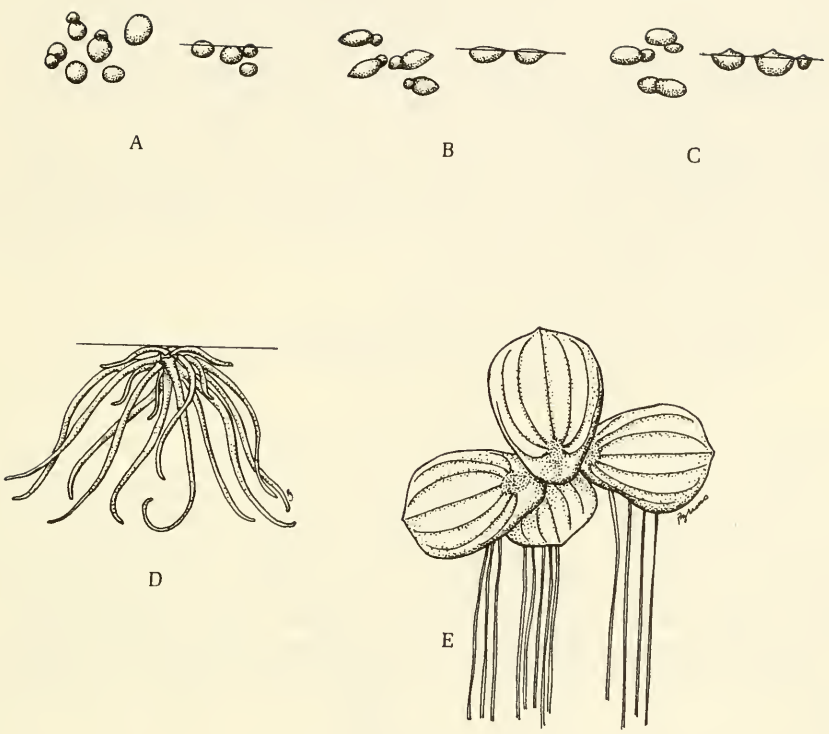


Figure 5.
Wolffia columbiana: **A. habit and floating view × 5.**
Wolffia borealis: **B. habit and floating view × 5.**
Wolffia brasiliensis: **C. habit and floating view × 5.**
Wolffiella gladiata: **D. floating view × 4.**
Spirodela polyrhiza: **E. habit × 4.**

2. Upper surface raised to a conspicuous papule (fig. 5C).
..... 3. *W. brasiliensis*

Wolffia columbiana Karsten Fig. 5, Map 6

Widely scattered in alkaline waters, rarely in acidic waters; ditches, ponds, lakes, and slow-moving rivers in New England. This and other species of *Wolffia* are often associated with stagnant and/or polluted waters. *Wolffia* is probably more common in New England than documented. Presently it is spreading northward, probably with the help of man. The plants readily stick to boats and are thus dispersed from one body of water to another. Range extends from southern Maine, central New Hampshire, and southwestern Quebec west to southern Ontario, Michigan, Wisconsin, Minnesota, and Manitoba, south to Florida, Louisiana, and eastern Texas; California south to northern South America.

Rare and endangered plant list: Maine

alkalinity: mean 48.0 mg/l; range 12.0-107.0 mg/l; (10)
pH: mean 7.4; range 6.8-7.9; (10)

2. *Wolffia borealis* (Engelm.) Landolt Fig. 5, Map 7

Rare in quiet waters of ditches, ponds, lakes, and slow-moving rivers in New England. This species appears in most manuals as *W. punctata* Griseb. but the name *W. borealis* has recently been applied by Landolt (1980). Range extends from New Hampshire, Vermont, Massachusetts, and Connecticut west to New York, Ontario, southern Minnesota, south to Florida, and eastern Texas; Washington and Oregon; West Indies. Most abundant in the central and eastern states.

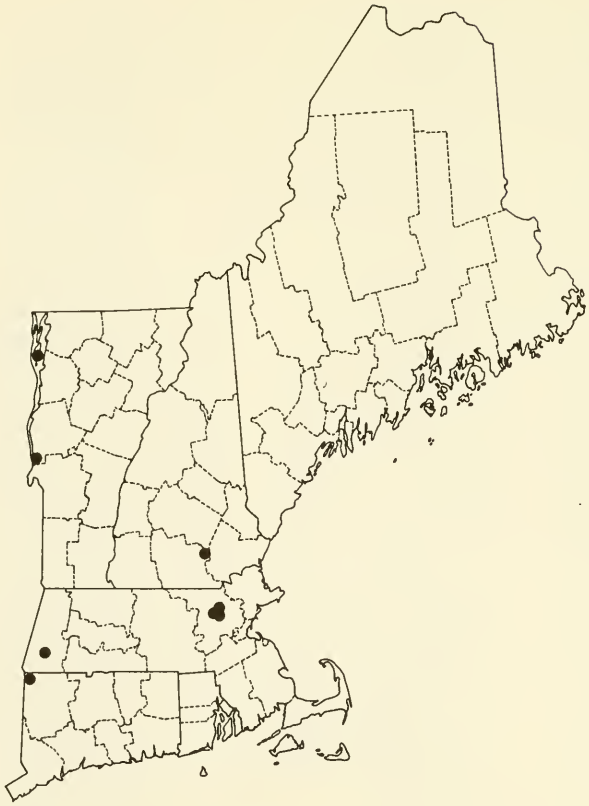
Rare and endangered plant list: Vermont

alkalinity: mean 34.4 mg/l; range 12.0-107.0 mg/l; (5)
pH: mean 7.3, range 6.8-7.9; (5)

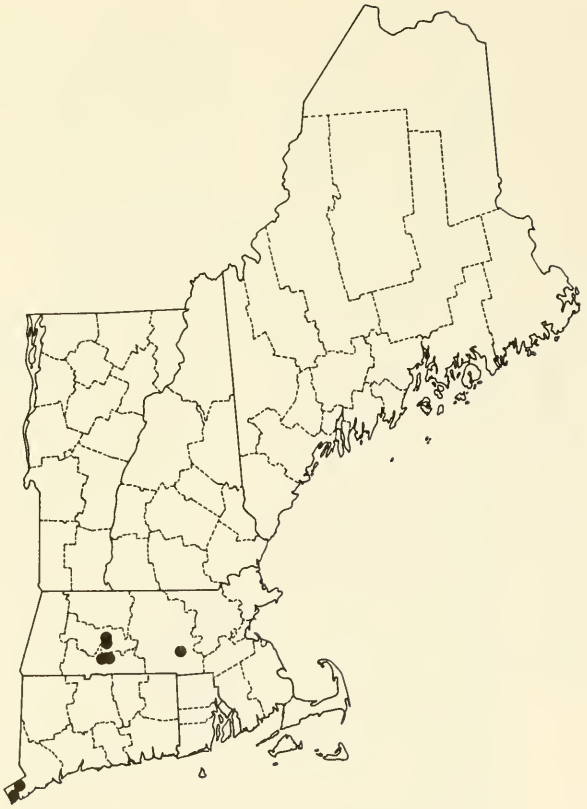
3. *Wolffia brasiliensis* Weddell Fig. 5, Map 8

Rare in widely scattered locations in Massachusetts and Connecticut. Landolt (1980) applies the name *W. brasiliensis* Weddell to the taxon referred to as *W. papulifera* C. H. Thompson in most manuals. Range extends from Massachusetts and Connecticut west to Illinois, Missouri, and Kansas, south to Florida and Texas; Mexico.

Rare and endangered plant list: Connecticut



Map 7.
Wolffia borealis



Map 8.
Wolffia brasiliensis

Wolffiella (Mud-midget, Bog-mat)

Tiny plants floating just below the water surface in quiet water; frond reduced, hollow, gradually narrowed from base to apex, 6-8 mm long, asymmetrical, linear-attenuate, falcate, or sigmoid, many times longer than wide; fronds occurring singly or cohering at the base and radiating in a stellate manner; flowers rare, consisting of a single pistillate and one staminate flower (with a single stamen) enclosed in a sac-like spathe; fruit a utricle; vegetative reproduction common.

1. *Wolffiella gladiata* (Hegelm.) Hegelm. Fig. 5, Map 9

Known from two locations in acidic waters of eastern Massachusetts. This species has been included in many manuals under the name *W. floridana* (J. D. Smith) Thompson but is now treated by Landolt (1980) as *W. gladiata*. Range extends from Massachusetts west to Wisconsin, Missouri, and Arkansas, south to Florida and Texas.

Rare and endangered plant list: New England

Spirodela (Great Duckweed, Duck-meat)

Small flattened floating plants of standing and slow-moving waters; fronds 5-11-nerved, with 6-18 roots; flowers consisting of 1 pistillate and 2 or 3 staminate flowers enclosed by a sac-like spathe; fruit a utricle; vegetative reproducton extensive.

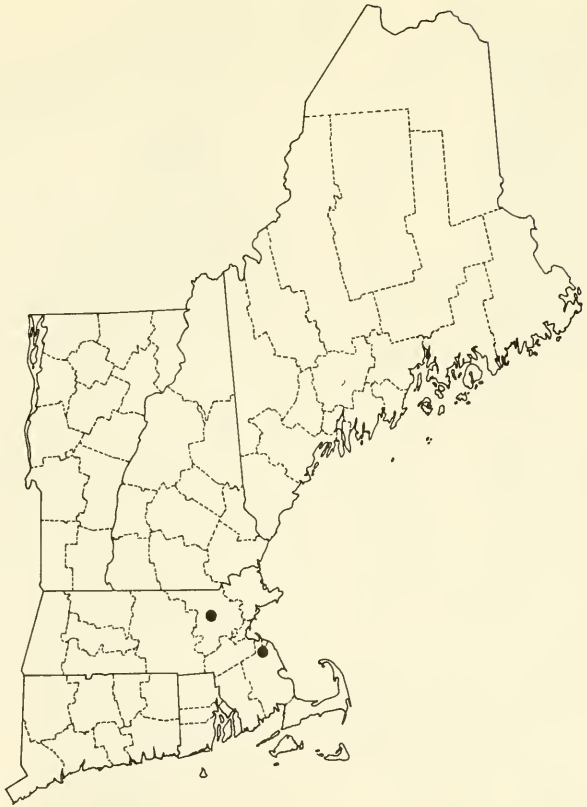
1. *Spirodela polyrhiza* (L.) Schleid. Fig. 5, Map 10

Common in standing and slow-moving water of ditches, ponds, lakes, and rivers throughout New England. Range extends from Prince Edward Island, New England, and southeastern Quebec west to southern British Columbia, south to Florida, Texas, and Mexico.

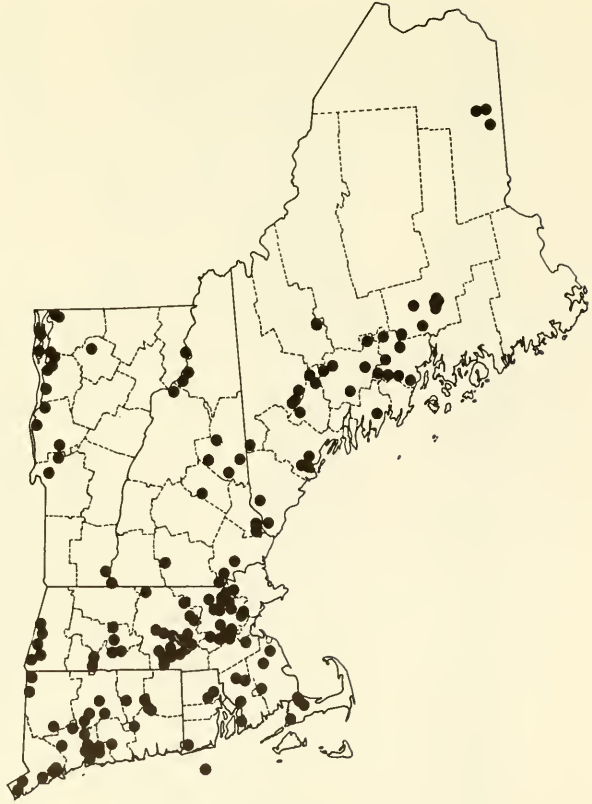
alkalinity: mean 43.5 mg/l; range 3.5-111.5 mg/l; (20)
pH: mean 7.1; range 5.7-7.9; (20)

Lemna (Duckweed)

Small flattened floating plants of standing and slow-moving waters; fronds 1-5-nerved, with one root; flowers minute, consisting of two staminate flowers (of a single stamen each) and one pistillate (of a single pistil), enclosed in a sac-like spathe; fruit a utricle; vegetative reproduction extensive.



Map 9.
Wolffiella gladiata



Map 10.
Spirodela polyrhiza

Key to Species

1. Fronds long-stalked, 6-15 mm long; lateral fronds usually remain attached to parent frond (fig. 6A,B); usually suspended below the surface, often in tangled mats.
   ..... 1. *L. trisulca*
1. Fronds sessile or nearly so, less than 6 mm long; forming single plants or small rosettes (fig. 6C,D,E); floating on surface.
   2. Fronds elliptic to linear-oblong, less than 0.5-1.5 mm wide with sides somewhat parallel and ends rounded (fig. 6C), obscurely 1-nerved.
      ..... 2. *L. valdiviana*
   2. Fronds broadly oblong, obovate or suborbicular, 1.2-3.0 mm broad with all sides curved (fig. 6D,E), obscurely 3-nerved.
      3. Root sheath with lateral wings; root-tip pointed, frond with apical and central papilla prominent.
         ..... *L. perpusilla*
      3. Root sheath without lateral wings; root-tip rounded, frond with apical papilla not prominent.
         ..... *L. minor*

1. *Lemna trisulca* L. Fig. 6, Map 11

Common in quiet alkaline waters of western New England, uncommon in less alkaline waters of eastern New England. This species occasionally forms extensive tangled mats encrusted with marl or may be tangled with other submerged aquatics. Range extends from the Magdalen Islands, Quebec and Nova Scotia west to Alaska, south to Florida, Alabama, Arkansas, Texas, New Mexico, and California; nearly worldwide.

Rare and endangered plant list: New Hampshire

alkalinity: mean 60.4 mg/l; range 26.0-153.0 mg/l; (6)
pH: mean 7.3; range 7.0-7.4; (6)

2. *Lemna valdiviana* Phil. Fig. 6, Map 12

Uncommon in quiet waters, mainly in southern New England. Range extends from northern New Hampshire and New York west to Ohio, southern Michigan, Illinois, Wyoming, and Oregon, south throughout the United States; Mexico and South America.

Rare and endangered plant list: New Hampshire

3. *Lemna perpusilla* Torr. Fig. 6, Map 13

Rare in quiet waters of southern New England. Range extends from Massachusetts and Connecticut west to New York, Ohio, Illinois, and Nebraska, south to Florida, Louisiana, and Texas; nearly worldwide.

4. *Lemna minor* L. Fig. 6, Map 14

Common in New England, occasionally in brackish water along the coast. In eastern Massachusetts this species is often associated with highly eutrophic or polluted waters. Range extends from Newfoundland, St. Pierre et Miquelon, and southern Labrador west to British Columbia, south to Florida and southern California; Mexico, worldwide.

alkalinity: mean 36.2 mg/l; range 2.5-127.0 mg/l; (46)
pH: mean 7.2; range 6.1-9.5; (43)

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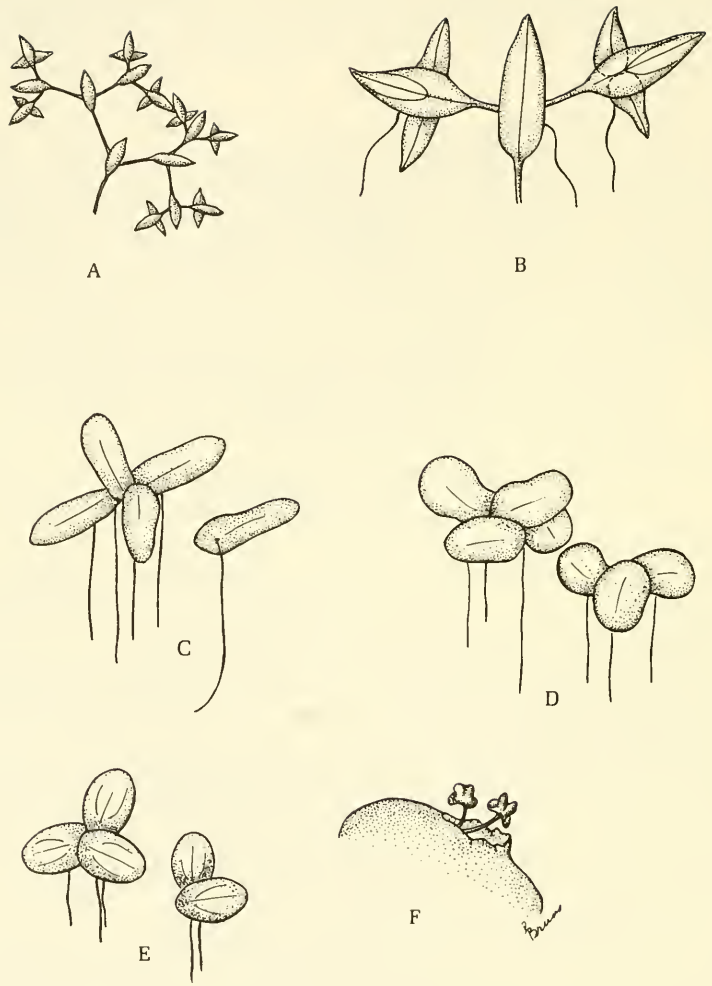
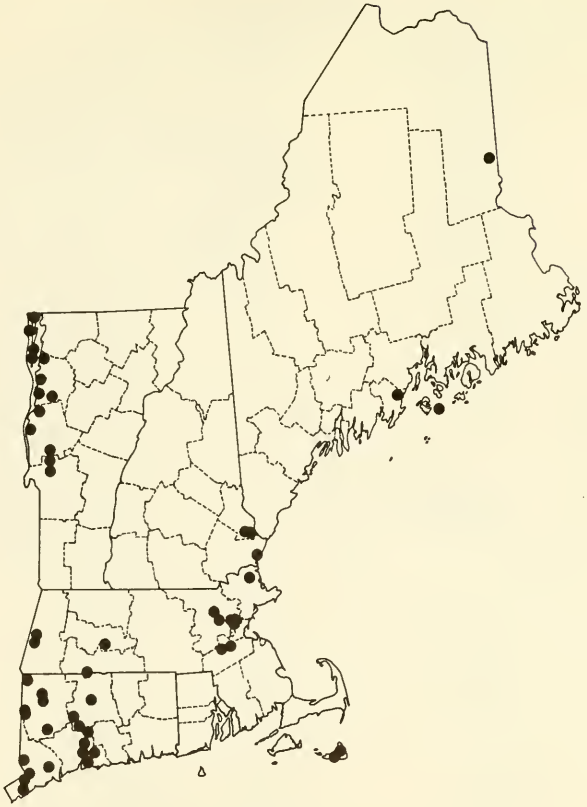
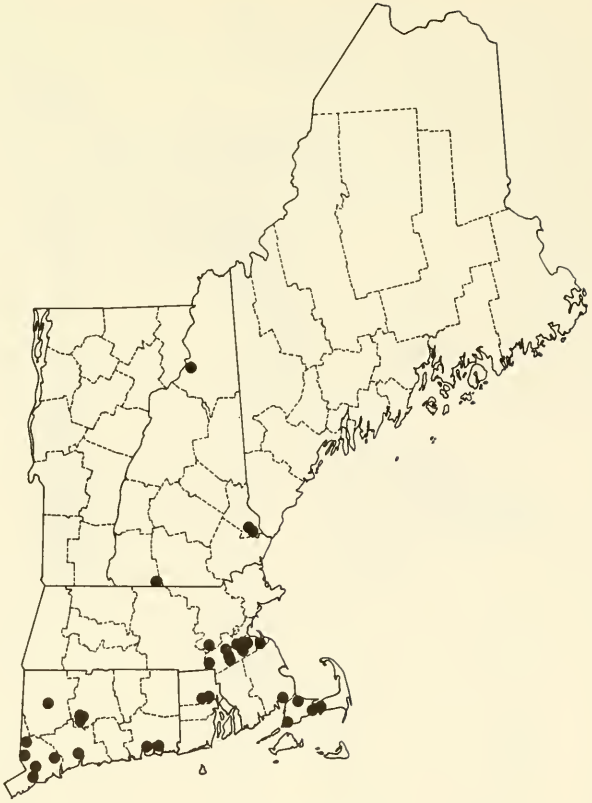


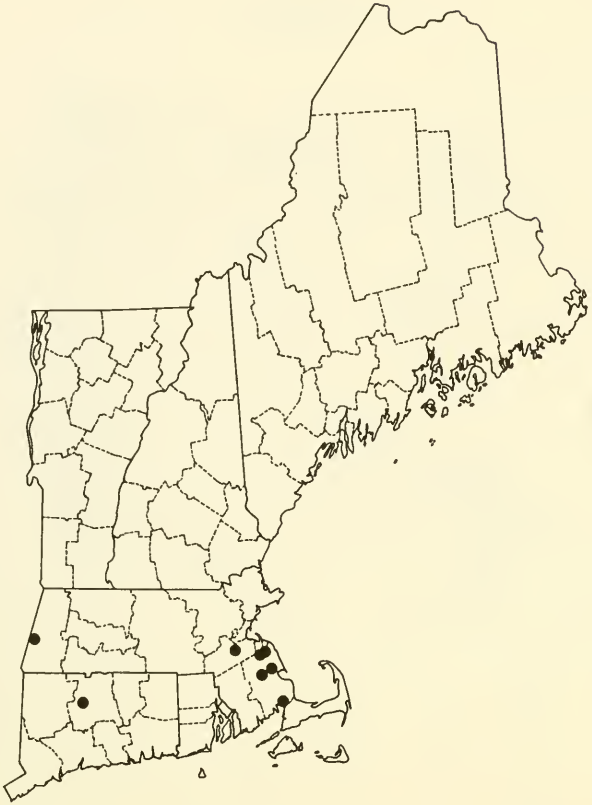
Figure 6.
Lemna trisulca: **A. habit × ½. B. habit of parent frond with lateral fronds remaining attached × 2.**
Lemna valdiviana: **C. habit × 5.**
Lemna perpusilla: **D. habit × 5.**
Lemna minor: **E. habit × 5. F. staminate flowers × 15.**



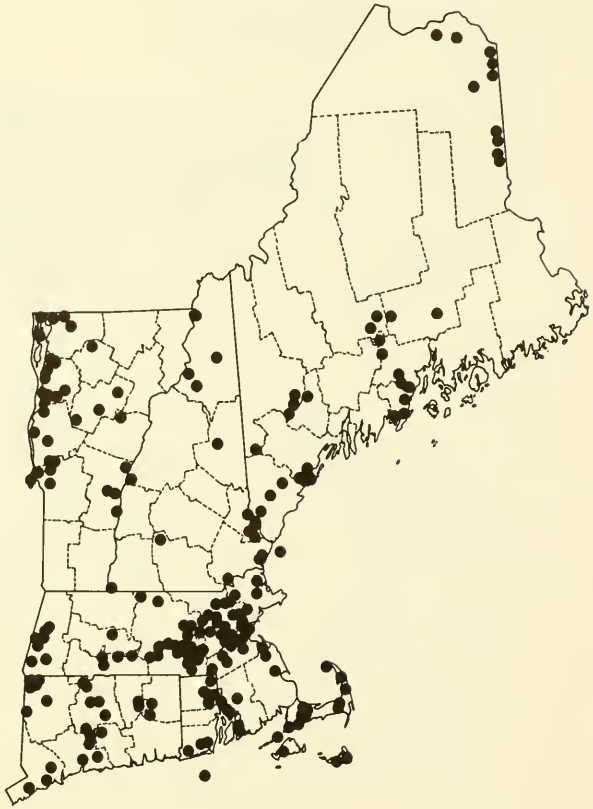
Map 11.
Lemna trisulca



Map 12.
Lemna valdiviana



Map 13.
Lemna perpusilla



Map 14.
Lemna minor

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XYRIDACEAE

Xyris (Yellow-eyed Grass)

Emersed plants of wet peaty or sandy soil. Perennial, growing from fibrous roots; leaves basal, tufted blades linear, bases abruptly or gradually dilated; flowers perfect, yellow, in the axils of leathery or chaffy imbricate bracts; fruit a capsule.

Key to Species

1. Plants bulbous and hard at base (fig. 7A); keel of lateral sepals ciliate from the apex to below the middle, with a tuft of longer hairs at the apex (fig. 7C).
   ..... 1. *X. torta*
1. Plants not bulbous, but soft and flattened at base (fig. 7E, 8A, 9A); keel of lateral sepals non-ciliate or cilia limited to the terminal half, keel with (fig. 8C, 9C) or without (fig. 7G) a terminal tuft of hairs at the apex.

2. Scales without a central green portion; leaves less than 2 mm wide; heads narrowly ellipsoid (fig. 7F); keel of lateral sepals entire.
..... 2. *X. montana*

2. Scales with central green portion; larger leaves 2-10 mm wide; head broadly ellipsoid (fig. 8B, 9B); keel of lateral sepals jagged or lacerate.
   3. Seeds ca. 0.5 mm long; tips of lateral sepals hidden by subtending bracts (fig. 8B); leaves 0.5-2.7 (rarely -6) mm wide.
..... 3. *X. difformis*
   3. Seeds 0.6-0.7 mm or longer; tips of lateral sepals extending beyond tips or sides of subtending bracts (fig. 9B); leaves 3-10 mm wide.
..... 4. *X. smalliana*

1. *Xyris torta* Sm. Fig. 7, Plate 1, Map 15

Common along damp or dryish sandy pond and lake shores of the Coastal Plain of southern New England; uncommon in New Hampshire. This species should be looked for in southwestern Maine. Range extends from central New Hampshire and Massachusetts west to Ontario, New York, Michigan, northern Indiana, and eastern Minnesota, south to Georgia, Texas, and Oklahoma.

2. *Xyris montana* Ries Fig. 7, Plate 2, Map 16

Widely scattered in acidic and rarely in alkaline areas along river banks and in wet sand and peat of New England. This species of *Xyris* is more common inland than along the Coastal Plain. Range extends from Newfoundland and Nova Scotia west to New England and northern Michigan, south locally to northern New Jersey and northeastern Pennsylvania.

Rare and endangered plant lists: New Hampshire, Vermont, Rhode Island, Connecticut

3. *Xyris difformis* Chapm. Fig. 8, Plate 3, Map 17

Common along sandy shores of acid ponds and lakes or bogs in the Coastal Plain, especially of southern New England. This species is listed in many manuals as *Xyris caroliniana* Walt., a name that Kral (1966) has applied to a taxon formerly known as *Xyris flexuosa* Muhl. Range extends from Nova Scotia and Maine west to New York, Ontario, Michigan, northern Indiana, and Wisconsin, south mainly along the coastal plain to Florida, Louisiana, and Texas.

Figure 7.
Xyris torta: **A. habit × ½. B. capitate inflorescence × 2¾. C. sepal × 5. D. seed × 22.**
Xyris montana: **E. habit × ½. F. capitate inflorescence × 2. G. sepal × 4. H. seed × 22.**

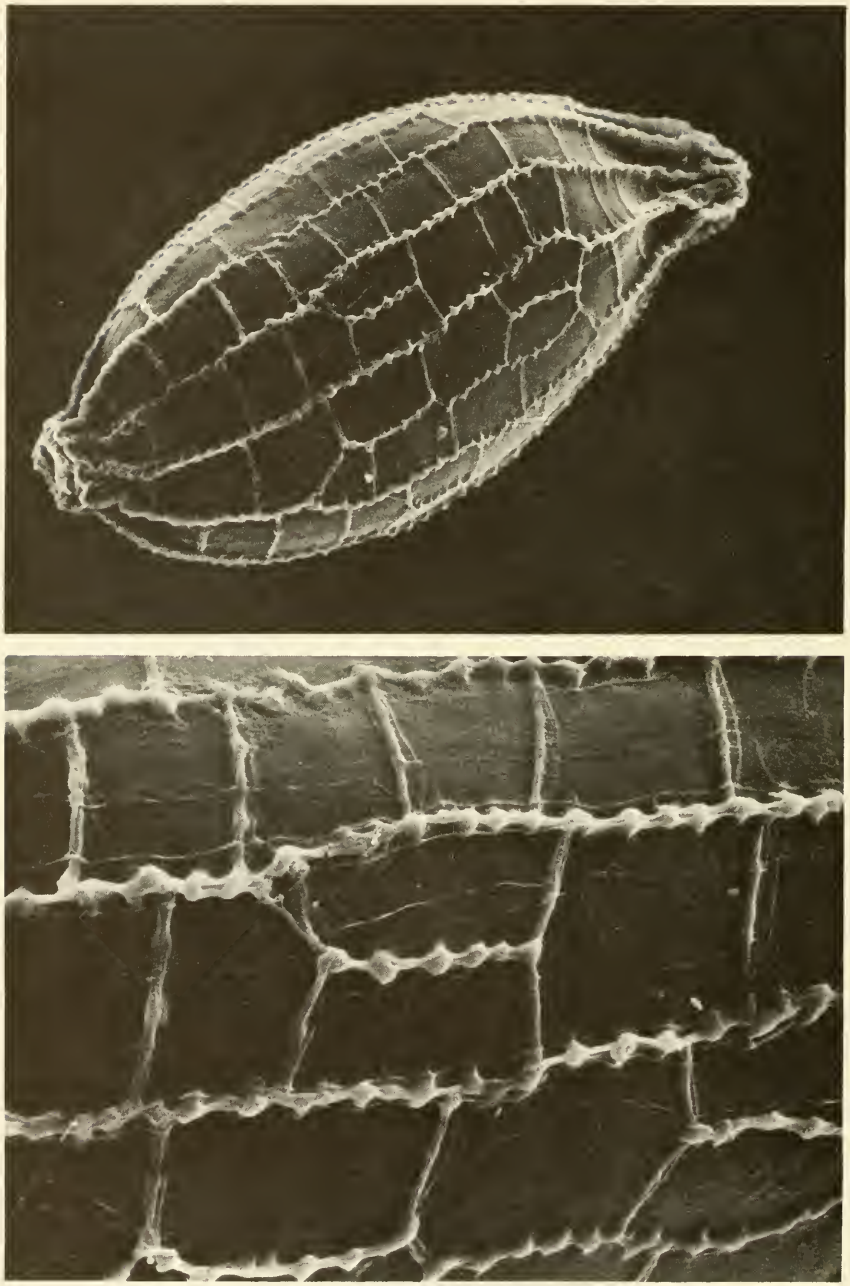


Plate 1.
***Xyris torta*: SEM photograph of seed × 200; detail showing ribbing, × 600.**

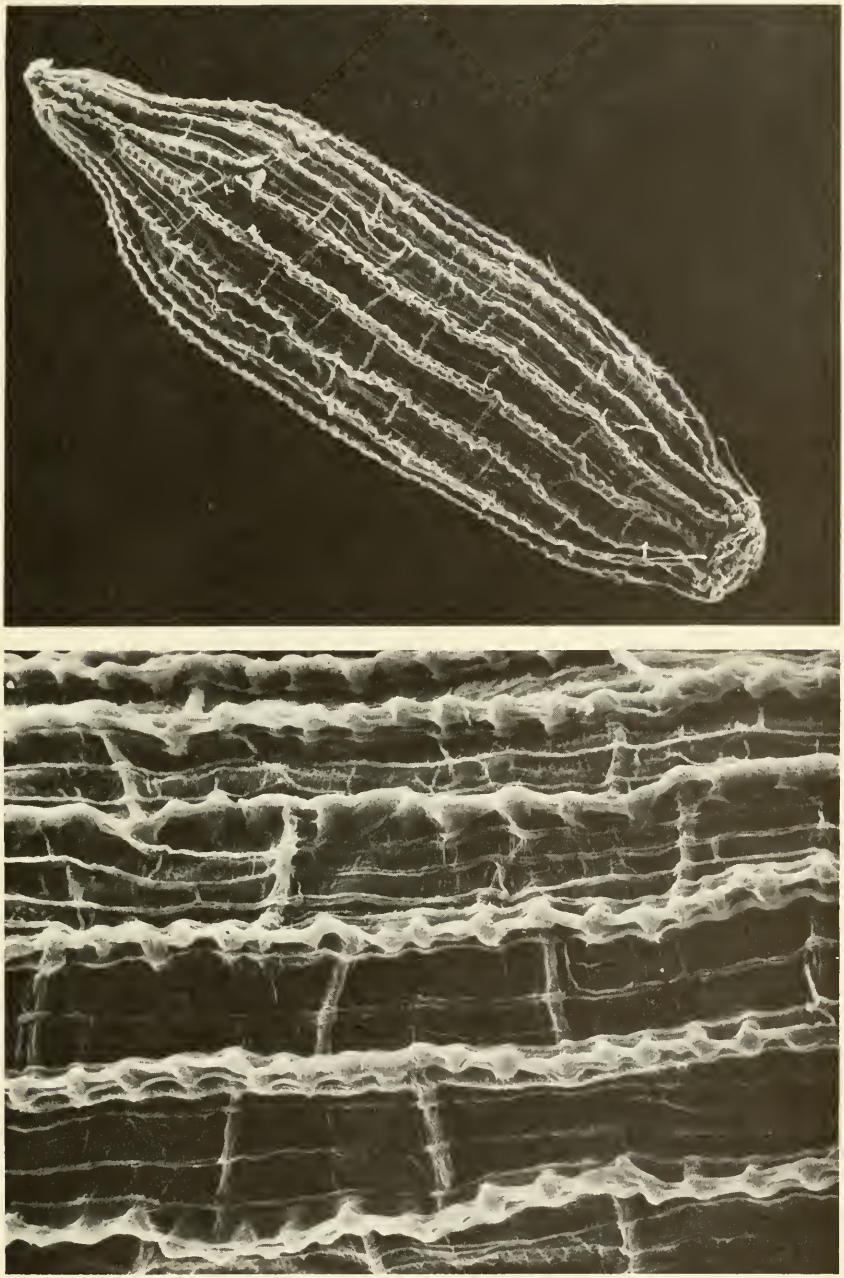


Plate 2.
Xyris montana: **SEM photograph of seed × 160; detail showing ribbing, × 600.**

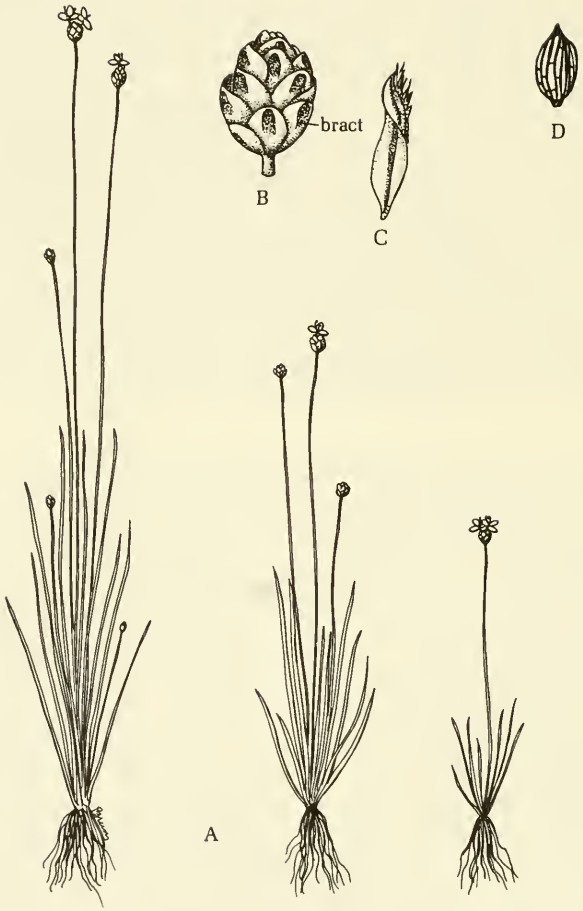


Figure 8.
Xyris difformis: **A. habit × ¼. B. capitate inflorescence × 2½. C. sepal × 5. D. seed × 22.**

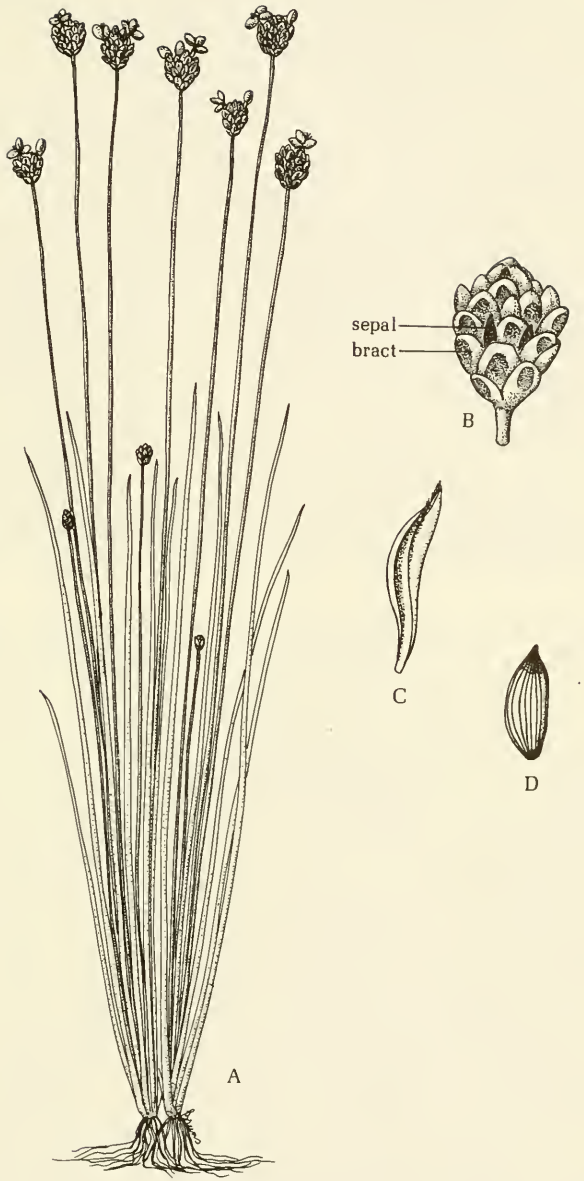


Figure 9.
Xyris smalliana: **A. habit × ¼. B. capitate inflorescence × 1½. C. sepal × 5. D. seed × 22.**

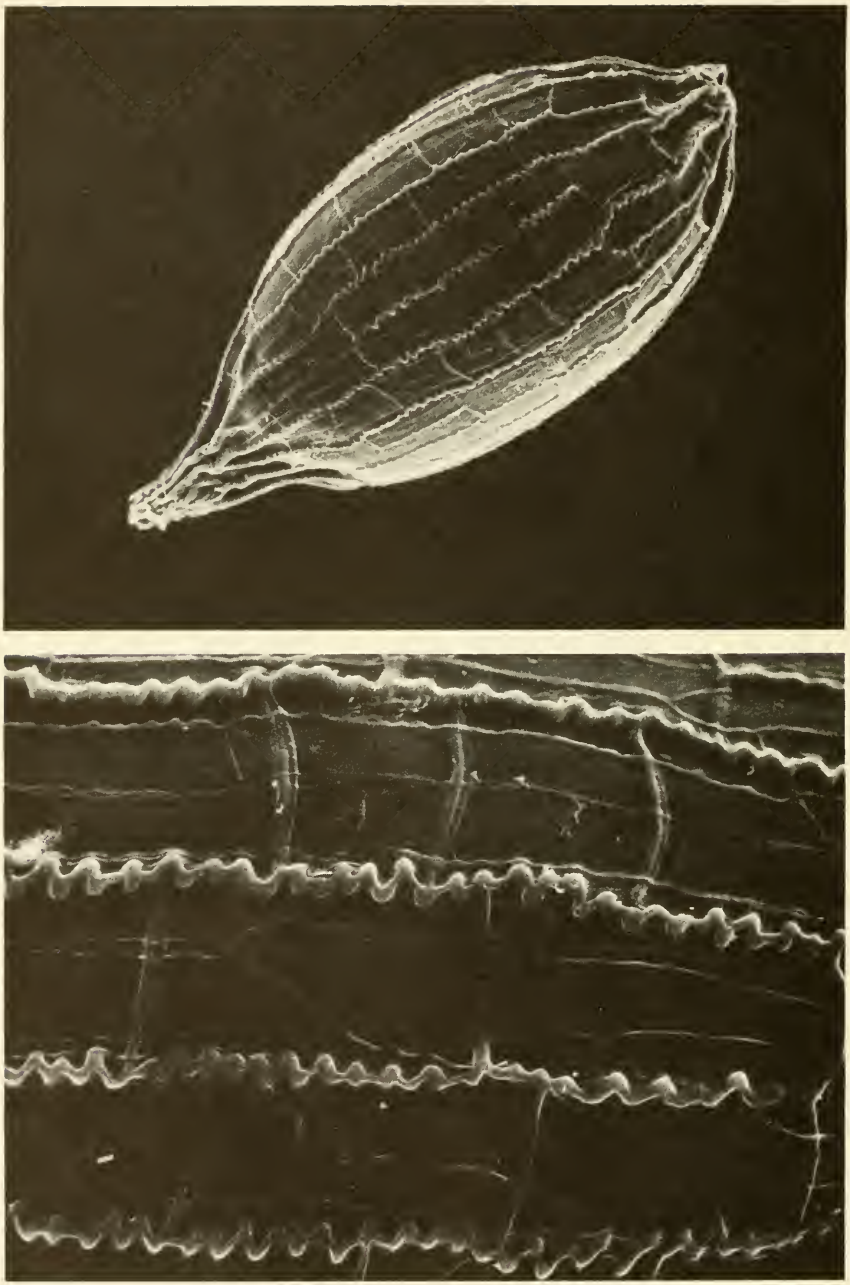


Plate 3.
Xyris difformis: **SEM photograph of seed × 160; detail showing ribbing, × 600.**

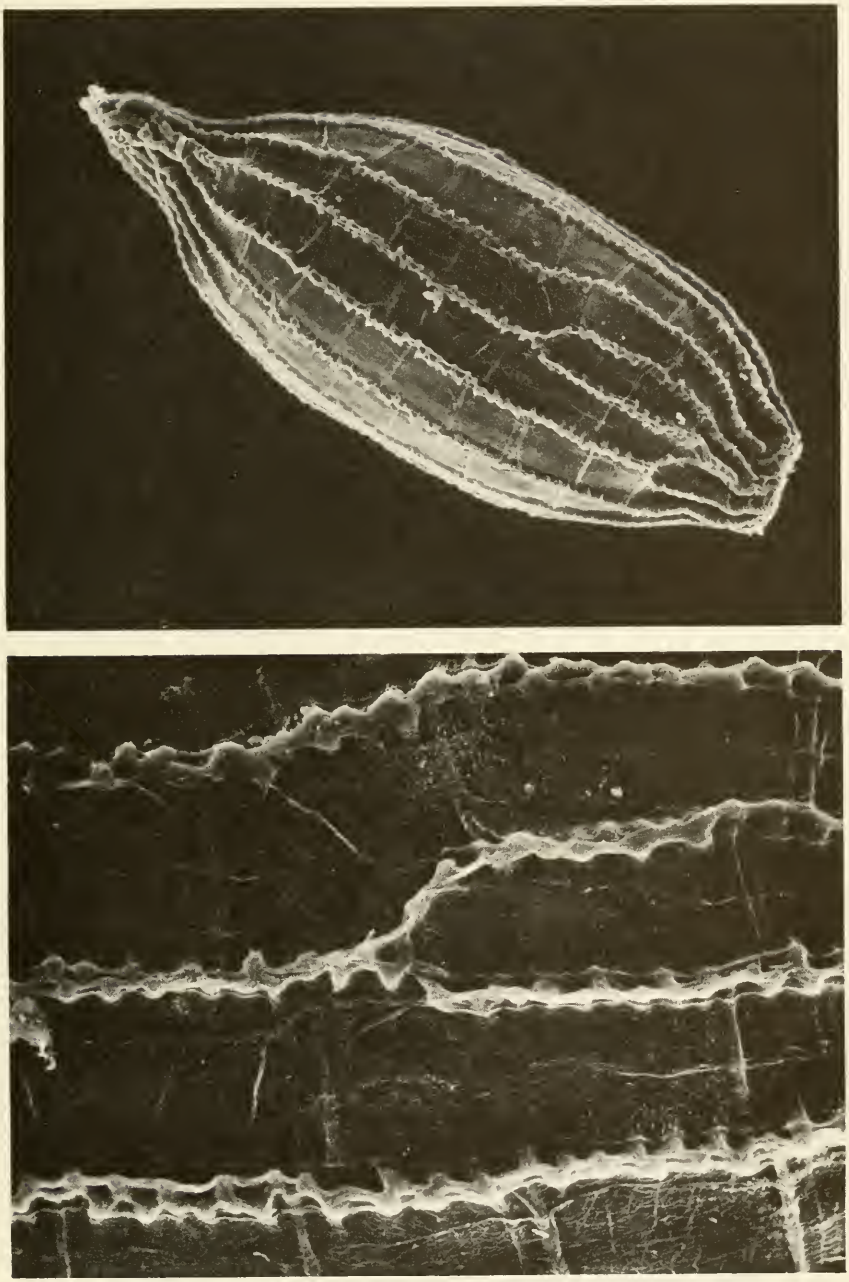
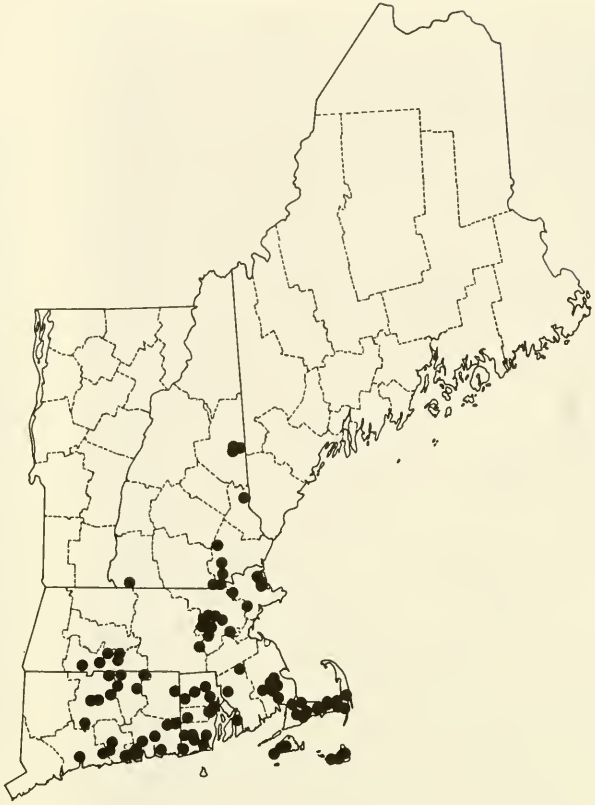
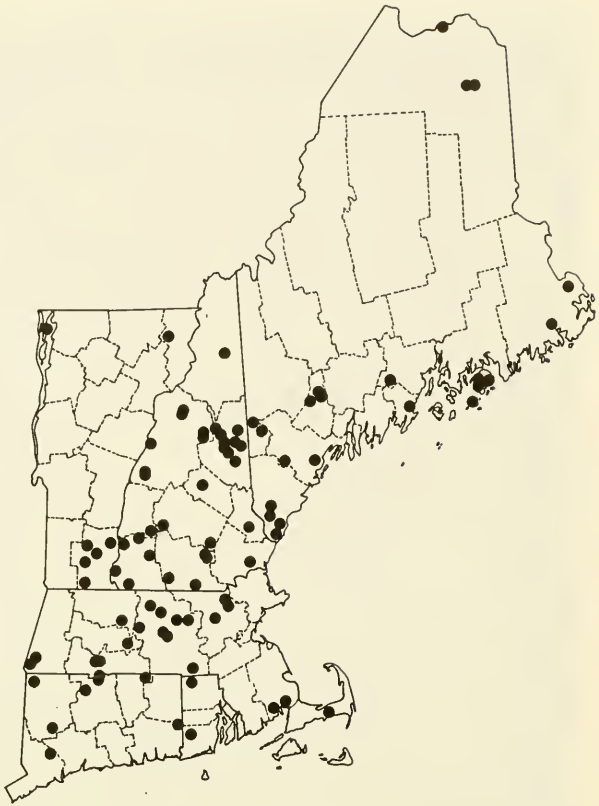


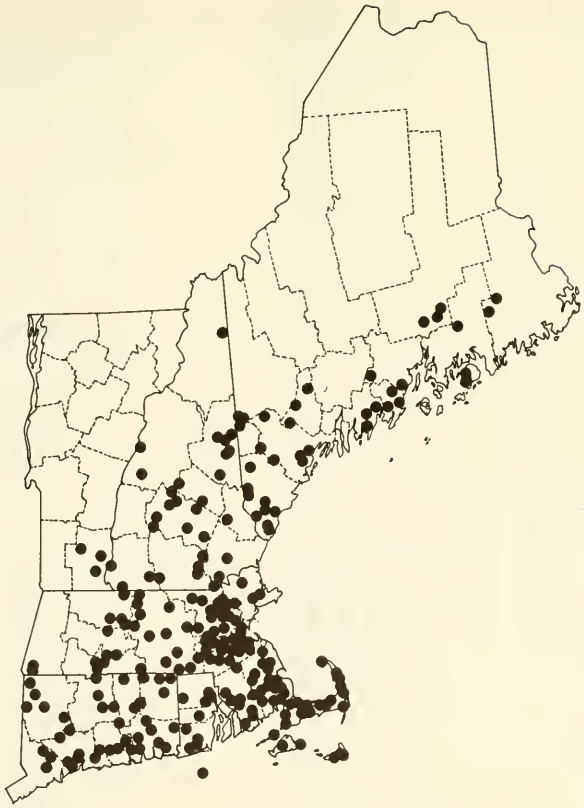
Plate 4.
Xyris smalliana: **SEM photograph of seed × 160; detail showing ribbing, × 600.**



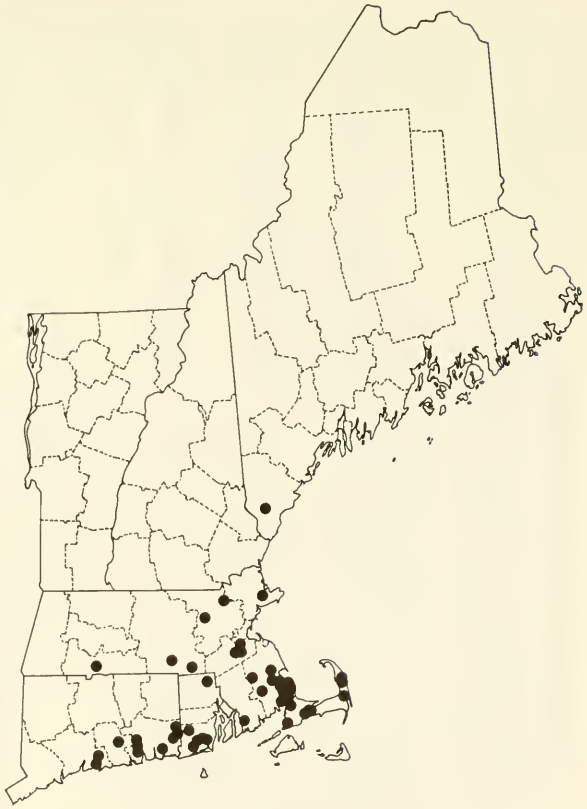
Map 15.
Xyris torta



Map 16.
Xyris montana



Map 17.
Xyris difformis



Map 18.
Xyris smalliana

Rare and endangered plant list: Vermont

alkalinity: mean 4.3 mg/l; range 1/0-8.5 mg/l; (4)
pH: mean 6.4; range 5.6-7.0; (4)

4. *Xyris smalliana* Nash. Fig. 9, Plate 4, Map 18

Uncommon to rare in acid bogs, and swamps and on muddy shores in New England. This is generally New England's largest and most robust *Xyris*. Occasionally *X. difformis* approaches it in size. Kral (1966) includes *X. congdonii* Small as a synonym under *X. smalliana*. Range extends from southern Maine southward along the coastal plain to Florida and Mississippi.

Rare and endangered plant list: Maine, Rhode Island, Connecticut

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Malme, G. O. K. 1937. Xyridaceae. N. Amer. Flora 19: 3-15.

ERIOCAULACEAE

Eriocaulon (Pipewort)

Emersed or submersed plants of sandy, gravelly, or peaty shores of rivers, lakes, and ponds or saline water of estuaries. Perennial, often tufted; roots conspicuously septate; leaves basal, linear, smooth, loosely cellular; inflorescence capitate; flowers unisexual, monoecious or dioecious, subtended by receptacular bractlets; fruit a loculicidal capsule.

Key to Species

1. Mature heads hemispherical (fig. 10F), dull gray or straw-colored, 3-4 mm broad; bractlets and perianth parts sparingly clavate-pubescent, some parts smooth; involucral bracts tend to remain ascending on flowering and fruiting heads, concealing the bractlets

and flowers (fig. 10F); scape 4-5 ridged; plants of estuaries.
..... 1. *E. parkeri*

1. Mature heads subglobose (fig. 10B), gray, appearing white due to perianth parts and bractlets, 4-5 mm broad; bractlets distinctly clavate-pubescent; involucral bracts reflexed in flowering and fruiting heads and partly concealed by hairy flowers (fig. 10B); scape (4-) 5-7 ridged; plant of fresh water.
..... 2. *E. septangulare*

1. *Eriocaulon parkeri* Robins. Fig. 10, Map 19

Rare, in saline water along estuaries of Maine, Massachusetts, and Connecticut. Range extends from the St. Lawrence River estuary of Quebec to Maine and south along the coast to North Carolina.

Rare and endangered plant lists: New England, Maine, Massachusetts, Connecticut.

2. *Eriocaulon septangulare* With. Fig. 10, Map 20

Extremely common in acid waters throughout New England. Submersed plants are often noted with scapes of up to 20 dm or more in length. Range extends from Newfoundland west to western Ontario, south to Long Island, New York, New Jersey, Delaware, mountains of North Carolina, northern Ohio, northern Indiana, Wisconsin, and Minnesota.

alkalinity: mean 9.6 mg/l; range 2.5-29.5 mg/l; (29)
pH: mean 6.9; range 5.8-8.3; (30)

Selected References

Kral, R. 1966. Eriocaulaceae of continental North America north of Mexico. Sida 2: 285-332.

Moldenke, H. N. 1937. Eriocaulaceae. N. Amer. Flora 19, pt. 1.

PONTEDERIACEAE

1. Stamens 6; flowers 2-lipped, in a dense, spicae inflorescence, blue-violet; leaves cordate, hastate or narrow to broadly lanceolate (figs. 11. 12).
..... *Pontederia*

1. Stamens 3; flowers regular, solitary, yellow, blue, or rarely white; leaves kidney-shaped (fig. 14) or linear (fig. 13).
..... *Heteranthera*

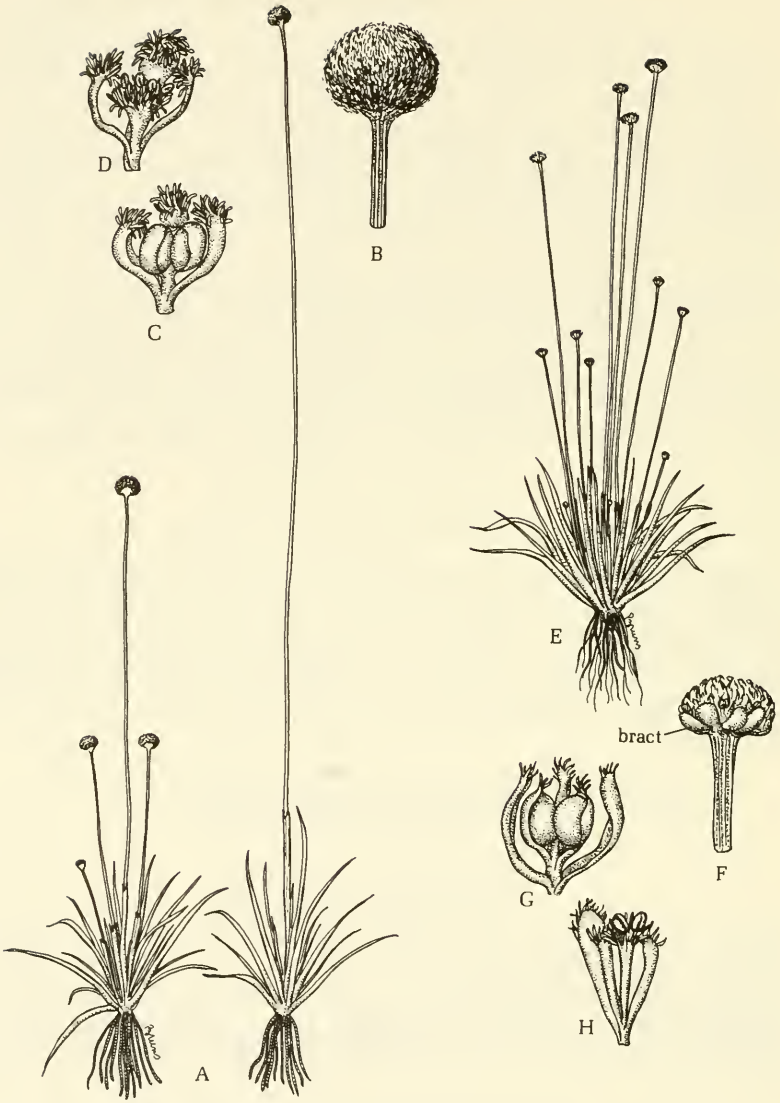
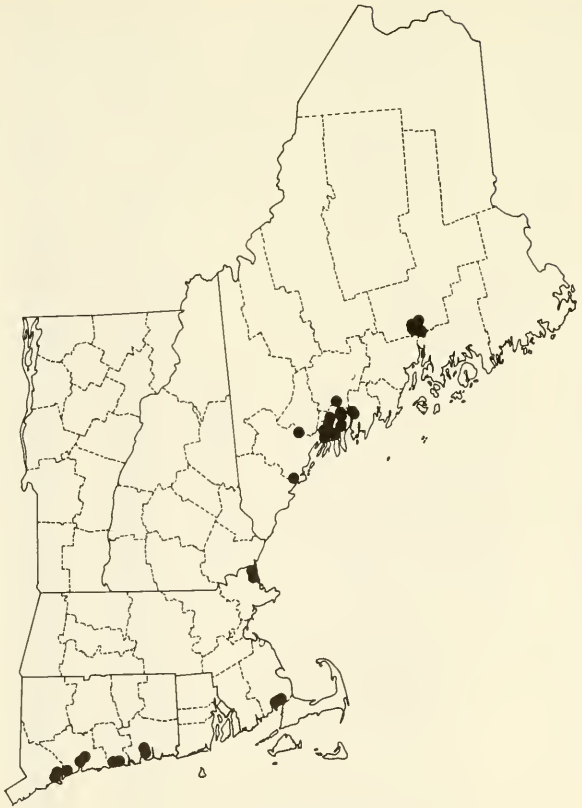
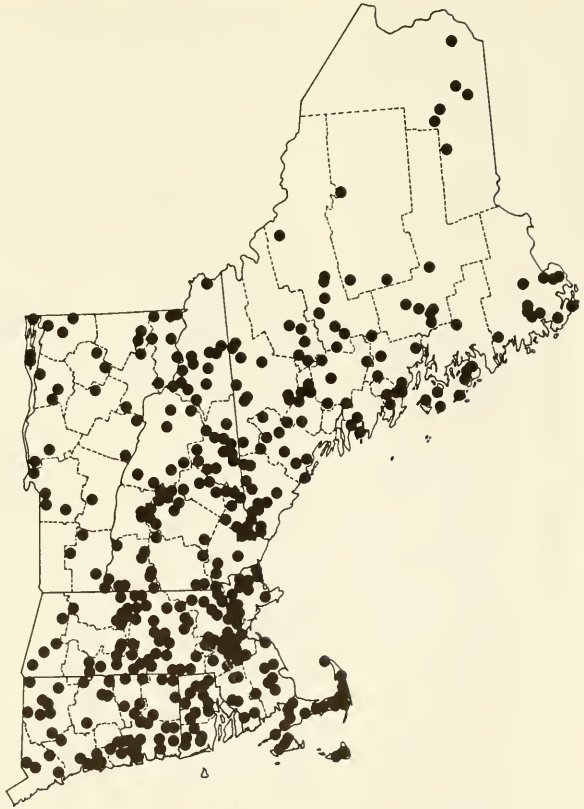


Figure 10.
Eriocaulon septangulare: **A. habit × ½. B. capitate inflorescence × 3. C. pistillate flower × 8. D. staminate flower × 8.**
Eriocaulon parkeri: **E. habit × ½. F. capitate inflorescence × 3. G. pistillate flower × 8. H. staminate flower × 8.**



Map 19.
Eriocaulon parkeri



Map 20.
Eriocaulon septangulare

Pontederia (Pickerel-weed)

Emergent plants of muddy or sandy shores of lakes, ponds, and streams. Perennial, growing from creeping rhizomes; leaves basal, erect, long-petioled, usually cordate; flowers violet-blue, in a dense spike with spathe-like bract; fruit a utricle crested with six toothed ridges.

1. *Pontederia cordata* L. Figs. 11, 12, Map 21

Extremely common along shores of lakes, ponds and streams throughout New England. The seedlings consist of submersed rosettes of linear leaves and often have one or two petiolate, slightly lanceolate leaves. Lowden (1973) recognizes a variety with narrow to broadly lanceolate leaves, var. *lancifolia* (Muhl.) Torr., whose range in North America is chiefly southern Coastal Plain. The range of variability in the leaves of this species is considerable and we question the occurrence of var. *lancifolia* in New England. Range extends from Nova Scotia west to southern Quebec, southern Ontario, Michigan, Wisconsin, and Minnesota, south along the coast to Florida, Alabama, Mississippi, Louisiana, and Texas; widely scattered throughout the other eastern states; greatest numbers in the coastal and Great Lakes states.

alkalinity: mean 20.3 mg/l; range 2.5-111.5 mg/l; (65)
pH: mean 7.0; range 5.0-8.9; (61)

Heteranthera (Mud-plantain)

Emersed or submersed plants of muddy shores, streams, and quiet waters; growing from rhizomes or with fibrous roots; stems often rooting at nodes; flowers blue, white, or yellow, emerging from the sheathing leaf bases; leaves alternate or in a basal rosette; fruit a capsule.

Key to Species

1. Leaves lax, long-linear, sessile (fig. 13A,B), usually submersed; flowers yellow; stamens unequal, anthers ovate, 2 yellow, 1 greenish. ..... 1. *H. dubia*
1. Leaves erect, reniform to cordate (fig. 14), petiolate, usually emersed; flowers white or pale blue; stamens equal, anthers sagittate, all 3 yellow. ..... 2. *H. reniformis*

1. *Heteranthera dubia* (Jacq.) MacM. Fig. 13, Map 22

Common in alkaline waters of western New England, rare eastward. The species is highly variable in leaf width, the widest leaves being slightly less than 1 cm. It is often confused with a few of the linear-leaved species of *Potamogeton*. The easiest way to separate it from *Potamogeton* is the presence of an obscure midvein in *Heteranthera* while in *Potamogeton* the midvein is distinct. Submersed plants often have small inconspicuous cleistogamous flowers. Plants stranded in the mud or floating in dense mats where foliage reaches the surface tend to produce "showy" yellow flowers. Thieret (1971) has made similar observations on *H. dubia* in Minnesota. Range extends from Maine, southwestern Quebec, and southern Ontario west to Minnesota, Idaho, and Oregon, south to Florida, Texas, Arizona, California, and Mexico.

Rare and endangered plant lists: Maine, New Hampshire

alkalinity: mean 63.5 mg/l; range 19.5-153.0 mg/l; (38)
pH: mean 7.8; range 6.8-9.5; (34)

2. *Heteranthera reniformis* R. and P. Fig. 14, Map 23

Rare, along muddy shores of rivers in southeastern Connecituct, the northernmost limit of its range. Range extends from southern Connecticut west to eastern New York, Kentucky, southern Illinois, Missouri, and Nebraska, south to Florida, Texas, and Mexico.

Rare and endangered plant list: New England, Connecticut

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Smith. R. B. 1917. A contribution to the life history of the Pontederiaceae. Bot. Gaz. (Crawfordsville) 25: 324-337.

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Wylie, R. B. 1917. Cleistogamy in *Heteranthera dubia*. Univ. Iowa Lab. Nat. Hist. Bull. 7: 48-58.

Figure 11.
Pontederia cordata: **A. habit × ⅛. B. inflorescence and cauline leaf × ¼. C. flower × 1. D. submerged seedling × ¼. E. submerged juvenile stage × ¼.**

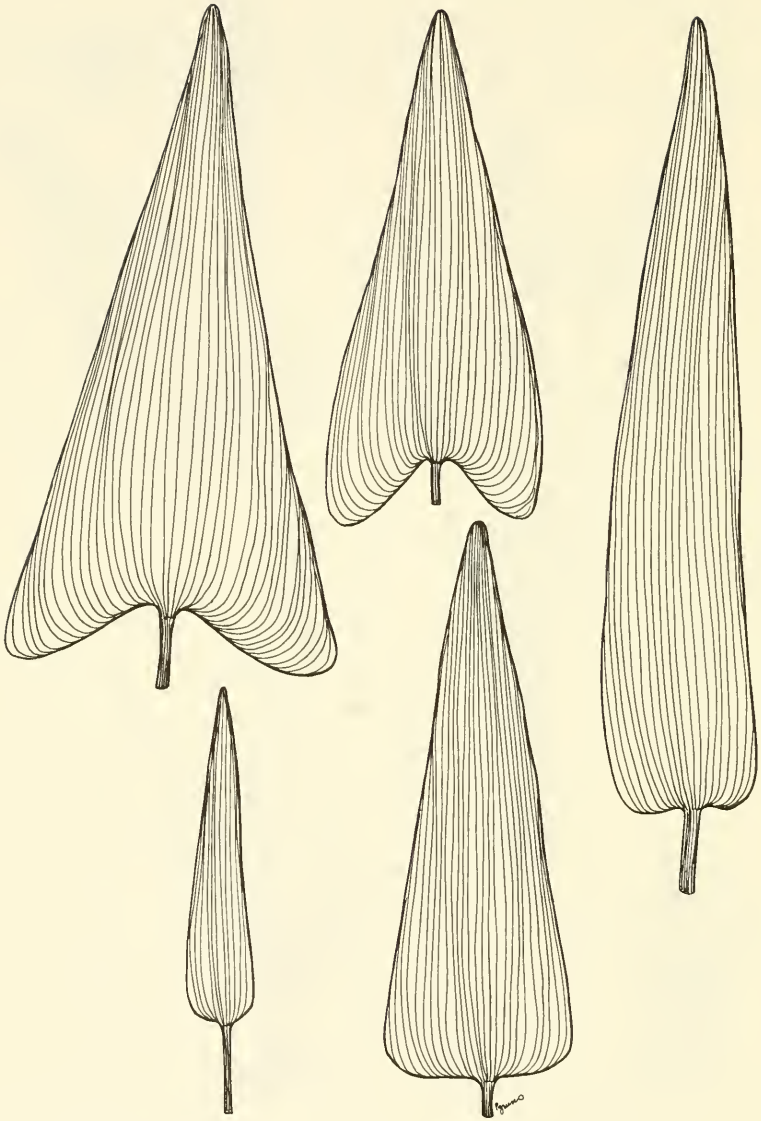
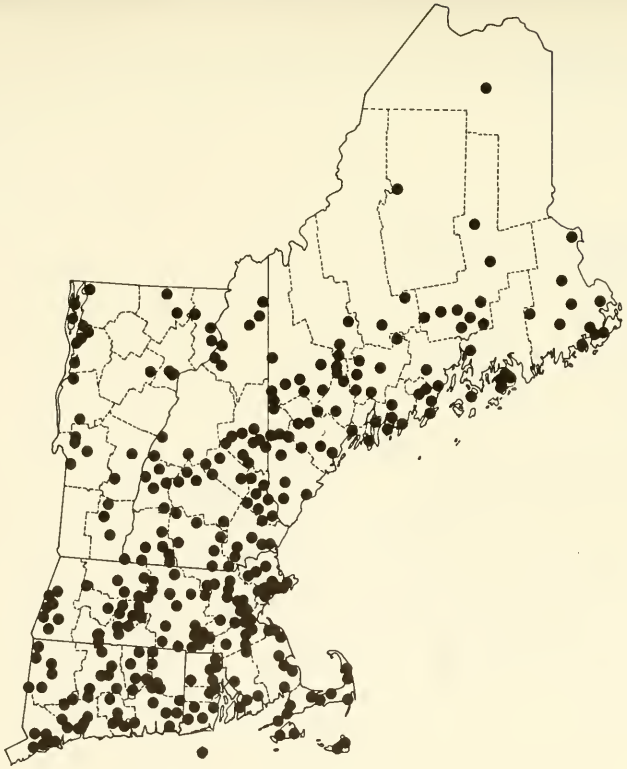


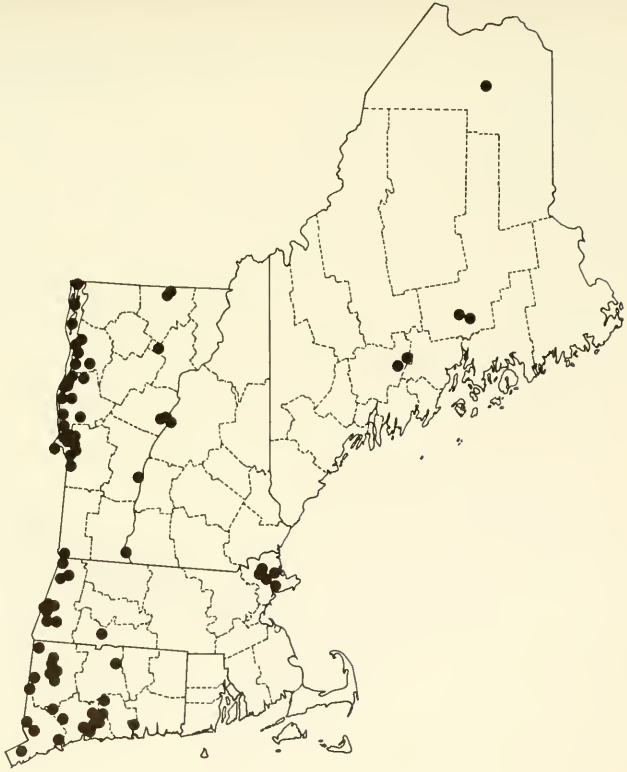
Figure 12.
Pontederia cordata: **leaf variation, all × ½.**

Figure 13.
Heteranthera dubia: **A. habit × ¼. B. portion of filiform growth form × ½. C. flower × 2.**

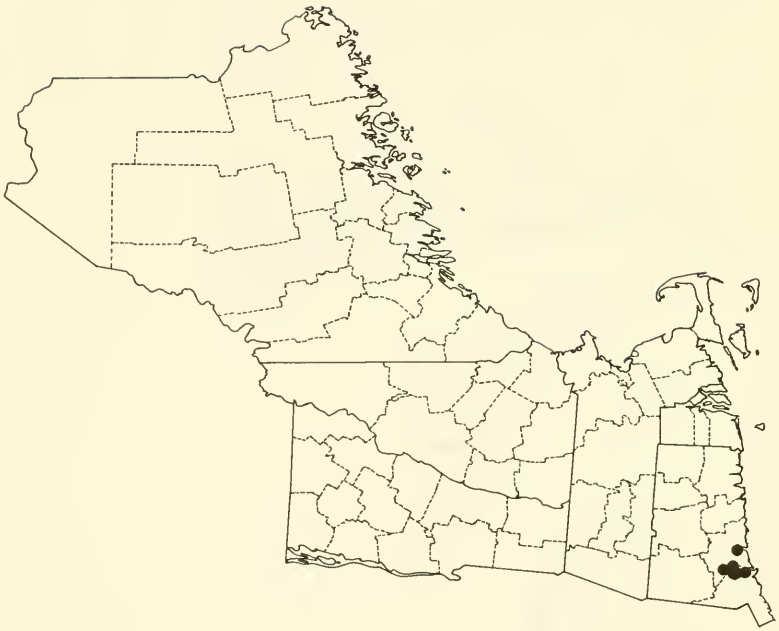
Figure 14.
Heteranthera reniformis: **habit × ½.**



Map 21.
Pontederia cordata



Map 22.
Heteranthera dubia



Map 23.
Heteranthera reniformis

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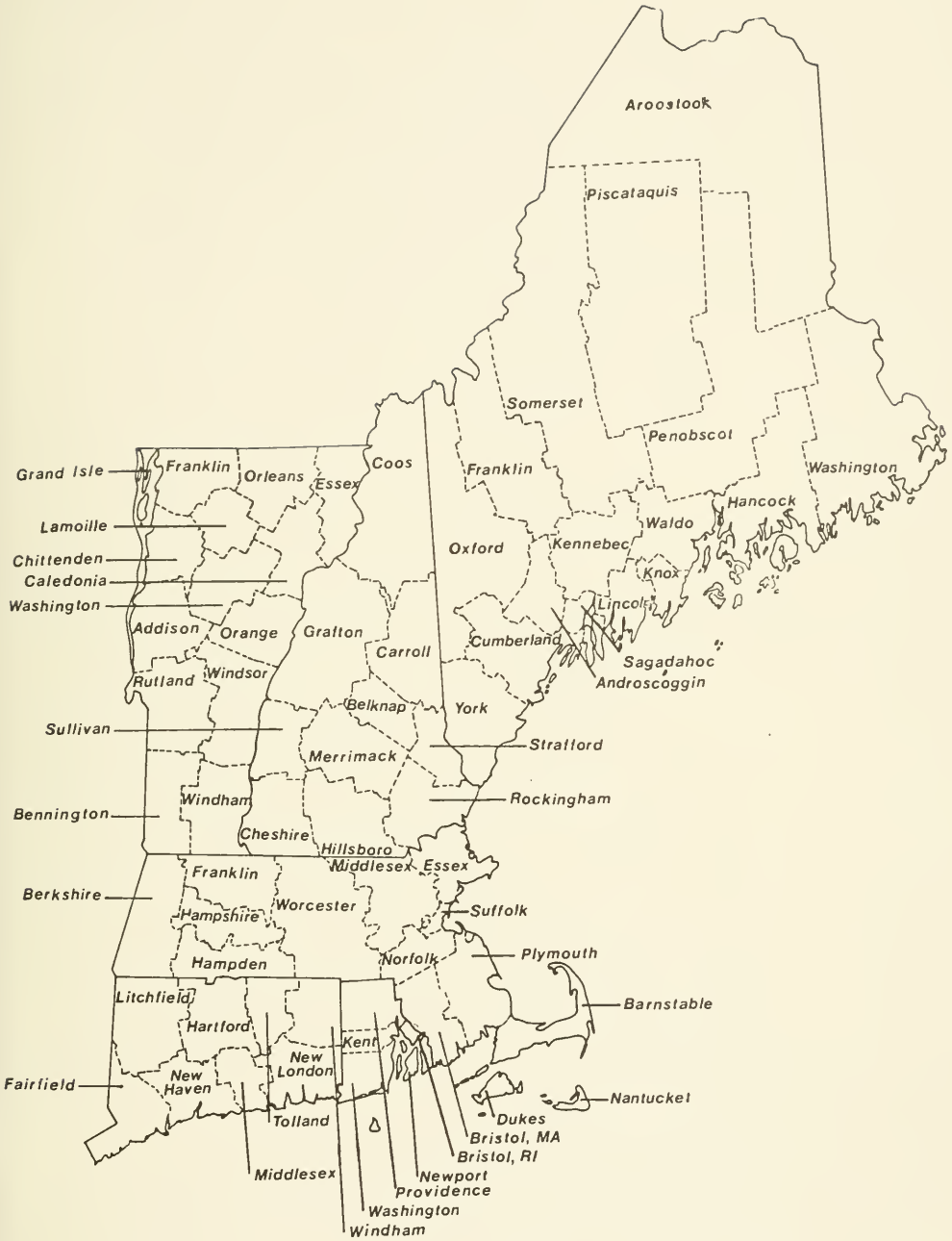
Aquatic Vascular Plants of New England: Part 3. Alismataceae. C. B. Hellquist and G. E. Crow. Bull. No. 518. 1981.

Aquatic Vascular Plants of New England: Part 4. Juncaginaceae, Scheuchzeriaceae, Butomaceae, Hydrocharitaceae. G. E. Crow and C. B. Hellquist. Bull. No. 520. 1982.

Hiker Traffic On and Near the Habitat of Robbins Cinquefoil, an Endangered Plant Species. R. E. Graber and G. E. Crow. Bull. No. 522. 1982.

ERRATA — Aquatic Plants of New England: Part 4. Juncaginaceae, Scheuchzeriaceae, Butomaceae, Hydrocharitaceae

Page 10, line 13 should read:
"dioecious" instead of "monoecious"


Aroostook
Piscataquis
Somerset
Penobscot
Franklin
Washington
Hancock
Waldo
Kennebec
Knox
Lincoln
Oxford
Cumberland
Sagadahoc
Androscoggin
Grand Isle
Franklin
Orleans
Essex
Coos
Lamoille
Chittenden
Caledonia
Washington
Addison
Orange
Grafton
Carroll
Rutland
Windsor
Belknap
York
Sullivan
Strafford
Merrimack
Windham
Rockingham
Bennington
Cheshire
Hillsboro
Middlesex
Essex
Franklin
Berkshire
Worcester
Hampshire
Suffolk
Hampden
Norfolk
Plymouth
Barnstable
Litchfield
Hartford
Kent
New London
New Haven
Fairfield
Tolland
Middlesex
Newport
Providence
Washington
Windham
Dukes
Bristol, MA
Bristol, RI
Nantucket